1,045,496

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,045,496

Inventor: SIDNEY GRANT

Date of filing Complete Specification: Oct. 15, 1964.

Application Date: July 15, 1963. No. 28026/63.

Complete Specification Published: Oct. 12, 1966.

Index at acceptance:—G2 A (D20A3B, D20A9, D20C2, D20F)

Int. Cl.:—G 03 d

COMPLETE SPECIFICATION

Apparatus for Photographic Developing

I, SIDNEY GRANT, a British subject, of 37 Queen's Walk, Kingsbury, London, N.W.9, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for photographic developing. It is concerned with the provision of apparatus which will enable developing of photographic materials, especially X-ray photographic plates, to be carried out automatically within a closed box, thus avoiding the necessity for the use of a dark room.

In accordance with the invention there is provided photographic developing apparatus comprising one or more treatment tanks, at least one carrying device for supporting the material to be developed in the treatment tank, each carrying device being pivotally mounted on an arm extending from and fixed to a carrier rod, a vertically-movable support bar at each side of the tank on which the rod rests, two longitudinally-reciprocable traction bars, one above and generally parallel to each support bar, each end of the rod carrying a cam which engages the traction bar when the rod is raised by the support bar and causes the rod to turn, lifting the carrying device on the end of the arm, and each traction bar having projections adapted to engage the respective cam when in its raised and turned position and thereby draw the carrier rod along the support bar, and drive mechanism for lifting and lowering the support bar and reciprocating the traction bar in synchronism to lift and transport the photographic material carried by the carrying device into and out of the tank.

The treatment tank or tanks and the associated transport mechanism will normally be enclosed in a light-tight box and in order to facilitate the insertion of the photographic material to be developed into the box without admitting light the box may be provided with a diaphragm consisting of four interlocking sheets of flexible elastic material comprising a first pair of sheets having edges which lie on a common first line and a second pair of sheets having edges which lie on a common second line intersecting the first line at an angle, each sheet having a part lying under one sheet of the other pair and a part lying over the other sheet of the other pair. Preferably the two lines intersect at right angles and form the diagonals of a square frame within which the sheets are secured, the sheets being thus triangular in outline. Such a diaphragm can be used in any situation where it is desired to provide for the passage of the hand or an instrument through the wall of a light-tight enclosure. The back of the diaphragm may be covered with a flap to prevent entry of light through the centre of the diaphragm where a small opening may be left at the meeting point of the four sheets.

The invention will now be described in more detail with the aid of an example illustrated in the accompanying drawings, in which:—

Figs. 1, 2 and 3 are, respectively, a general perspective view, a longitudinal section and an internal plan view of a developing box intended for use in developing dental X-ray film.

The films are supported by a carrying device 10 having inclined strips 9 forming between them a number of vertical slots 11 of parallelogram section which are of such a size that the standard size of film for dental X-rays fits in the longer diagonal of the slot. The films 12 rest on a horizontal bar 13. One side of the carrying device is formed by a wall 14 but the other side is open over the major part of its height. The carrying device 10 is pivotally supported by arms 15 fixed to a carrier rod 16. In the position shown, the carrying device 10 is located in a loading compartment 17 divided from the rest of the interior of a housing 18 by a partition 19. The end wall 20 of the housing 18 is provided

[*Price 4s. 6d.*]

with two diaphragms 21 and 22 through which the films can be inserted in the loading compartment 17 and through which the hands of the operator can pass to remove the protective covers from the films and place the films in the carrying device 10. Handling of the films is facilitated by visual observation through a dark glass window 23, the loading compartment 17 being illuminated by an appropriate safe lamp 24.

The diaphragms 21 and 22 are identical in construction and it will suffice to describe the diaphragm 21. This consists of four triangular sheets 25 of rubber each secured by two sides in a square frame 26. The third side of each triangular sheet 25 lies on one of the diagonals of the square frame 26. Proceeding round the frame, each sheet 25 is half-covered by the next sheet and half-covers the preceding sheet. Behind each diaphragm is a curtain 27 which prevents the entry of light through the centre of the diaphragm even when this is partially opened by the pressure of the operator's hand. Before the hands are removed from the loading compartment 17 a starting button 28 located within the compartment is pressed to initiate the operation of the transport mechanism which transfers the films 12 in the carrying device 10 to a developing tank 29, after which the hands can be removed without any risk of admitting light affecting the films.

After remaining in the developing tank 29 for the time necessary for development the films are transferred to a wash tank 30 and then to a fixing tank 31, where they remain for a predetermined period before being removed from the apparatus for examination. A single transport mechanism serves to effect the successive transfers of the films from the loading compartment 17 to the developing tank 29, through the wash tank 30 and into the fixing tank 31.

The transport mechanism includes at each side of the tanks 29, 30 and 31 a vertically-movable support bar 32 which is mounted on two pivotally-mounted arms 33 and 34. The arm 34 is extended beyond its pivot and this extension is moved by a rotary cam 35 to raise and lower the support bar 32. The lower and upper extreme positions of the bar 32 are shown in full and broken lines respectively in Fig. 2. An adjustable stop screw 36 is fitted on the bar 32 to limit the downward movement by engagement with the arm 34. The end of the arm 34 engaging the cam 35 is split and is adjustable by a screw 37 to set the upper position of the bar 32 as required for correct operation. Above the support bar 32 is a transport or traction bar 39 slidably mounted in supports 40 and reciprocable by means of a swinging arm 41 pivoted at 42 and driven by a rotating disc 43 having an eccentric pin 44 which moves in a slot in the arm 41, whose upper end is coupled to the traction bar 39 by a rod 45. The discs 43 and the cams 35 are carried on a common driving shaft 46 rotated by an electric motor 47 through a gearbox 48.

In the initial position shown in the drawing the carrier rod 16 rests in a notch in a bracket 49 attached to the upper edge of the partition 19 at each side of the tanks. The rod 16 has a cam 50 fixed to each end, the cam having a straight limb on one side of the rod and a curved limb on the other side. As the support bar 32 is raised by the action of the cam 35 it engages and lifts the rod 16 and thereby raises the cam 50 into engagement with the traction bar 39. This engagement causes the rod 16 to rotate until the cam 50 and the arms 15 occupy the positions shown in broken lines. It will be noted that the carrier 10, freely pivoted at the ends of the arms 15, still hangs downwards and that the lifting of the carrier has been obtained largely by swinging of the arms 15 and only to a small extent by bodily lifting of the carrier rod 16 and the elements attached to it. In this raised position of the carrier 10 it is clear of the upper edges of the partition 19 and the tanks 29, 30 and 31 and can be moved along to a position above the next tank, in this case the developing tank 29. This movement is effected by movement of the traction bar 39 to the position indicated in broken lines, the traction bar 39 having downwardly projecting pins 51, one of which engages the cam 50 and thus draws the carrier rod 16 along the support bar 32. The carrier rod 16 rests in shallow recesses 52 in the support bar 32 to prevent the carrier rod being moved by frictional engagement of the traction bar 39 with the cam 50. The pins 51 move the rod 16 from one recess 52 to the next.

Lowering of the support bar 32 after the carrier rod 16 has been moved along by the traction bar 39 allows the carrying device 10 to drop into the tank 29 as the cam 50 rotates to its initial position. Transfer of the films to the subsequent tanks is effected by a repetition of the movements described. As the films are lowered into the developing tank 29 the lower end of the cam 50 comes to rest on a pivoted arm 53 which operates a micro-switch 54. By means of an electrical control circuit this stops the operation of the transport mechanism for a period determined by an adjustable timer 61, after which the transport mechanism is restarted to move the plates to the wash tank 30. They are lowered into and lifted out of the wash tank without any delay and are transferred to the fixing tank 31 where again the cam 50 comes to rest on an arm 55 which trips a micro-switch 56 to initiate a delay circuit which energises a lamp 57 to give a signal to the operator when it is safe to open a lid 58 hinged at 59 and fitted with a handle 60, and remove the carrying device 10 with the films 12 from the fixing tank 31.

The carrying device 10 may be replaced by a number of clips for individual films which are swingably supported on a rod carried by the arms 15. Preferably the clips are equipped with struts which rest against the wall 19 and hold the films away from that wall.

WHAT I CLAIM IS:—

1. Photographic developing apparatus comprising one or more treatment tanks, at least one carrying device for supporting material to be developed in the treatment tank, each carrying device being pivotally mounted on an arm extending from and fixed to a carrier rod, a vertically-movable support bar at each side of the tank on which the rod rests, two longitudinally-reciprocable traction bars, one above and generally parallel to each support bar, each end of the rod carrying a cam which engages the traction bar when the rod is raised by the support bar and causes the rod to turn, lifting the carrying device on the end of the arm, and each traction bar having projections adapted to engage the respective cam when in its raised and turned position and thereby draw the carrier rod along the support bar, and drive mechanism for lifting and lowering the support bar and reciprocating the traction bar in synchronism to lift and transport the photographic material carried by the carrying device into and out of the tank.

2. Apparatus as claimed in claim 1 enclosing a light-tight box provided with at least one diaphragm to facilitate insertion of photographic material to be developed without the admission of light, the diaphragm consisting of four interlocking sheets of flexible elastic material comprising a first pair of sheets having edges which lie on a common first line and a second pair of sheets having edges which lie on a common second line intersecting the first line at an angle, each sheet having a part lying under one sheet of the other pair and a part lying over the other sheet of the other pair.

3. Apparatus as claimed in claim 2 in which the two lines intersect at right angles and form the diagonals of a square frame in which the sheets are secured.

4. Apparatus as claimed in any of claims 1 to 3, in which the drive mechanism includes an electric motor driving a shaft carrying cams which engage levers on which the support bars are mounted and also carrying eccentrically-positioned pins which engage slots in swinging arms which are coupled to the traction bars.

5. Apparatus as claimed in any of the preceding claims including a carrying device having a plurality of vertical slots of parallelogram section positioned side by side and of such a size as to accommodate a piece of film in the longer diagonal of the parallelograms so that it is supported by its edges and treatment liquids can pass freely over the surfaces of the pieces of film.

6. Photographic developing apparatus substantially as described with reference to the drawings.

REDDIE & GROSE,
Agents for the Applicant,
6, Bream's Buildings,
London, E.C.4.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press (Leamington) Ltd.—1966. Published by The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

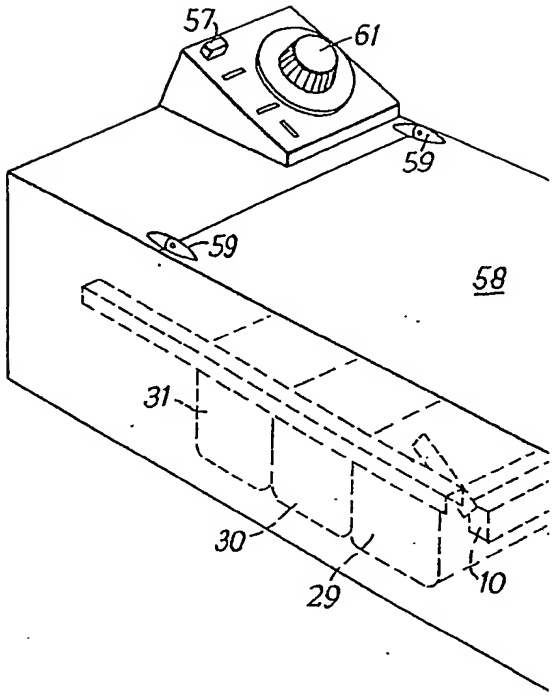
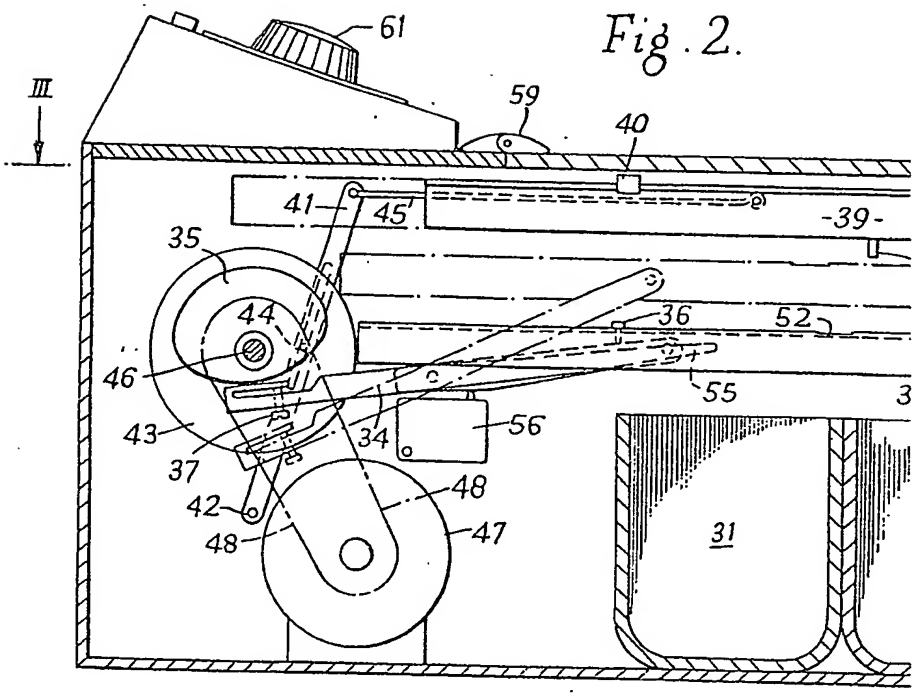
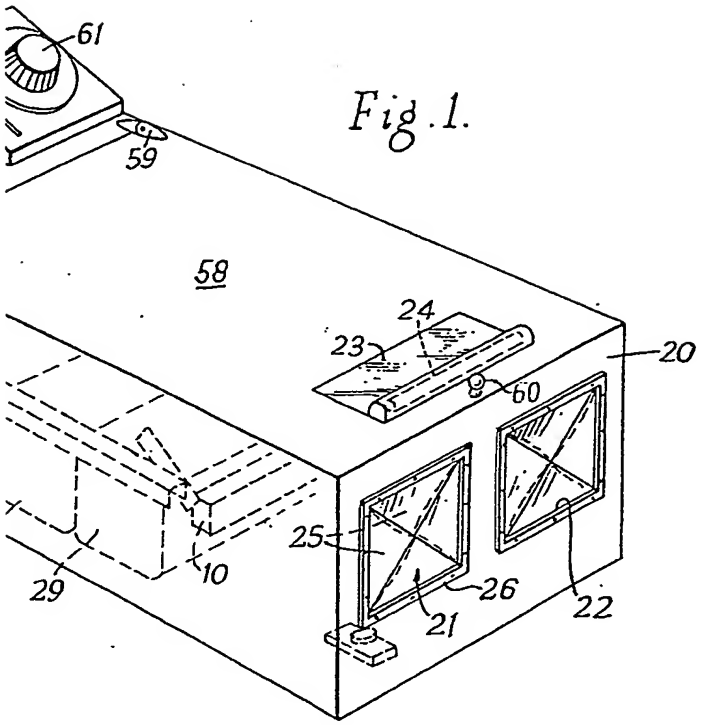

57
61
59
59
58
31
30
29
10

Fig. 2.

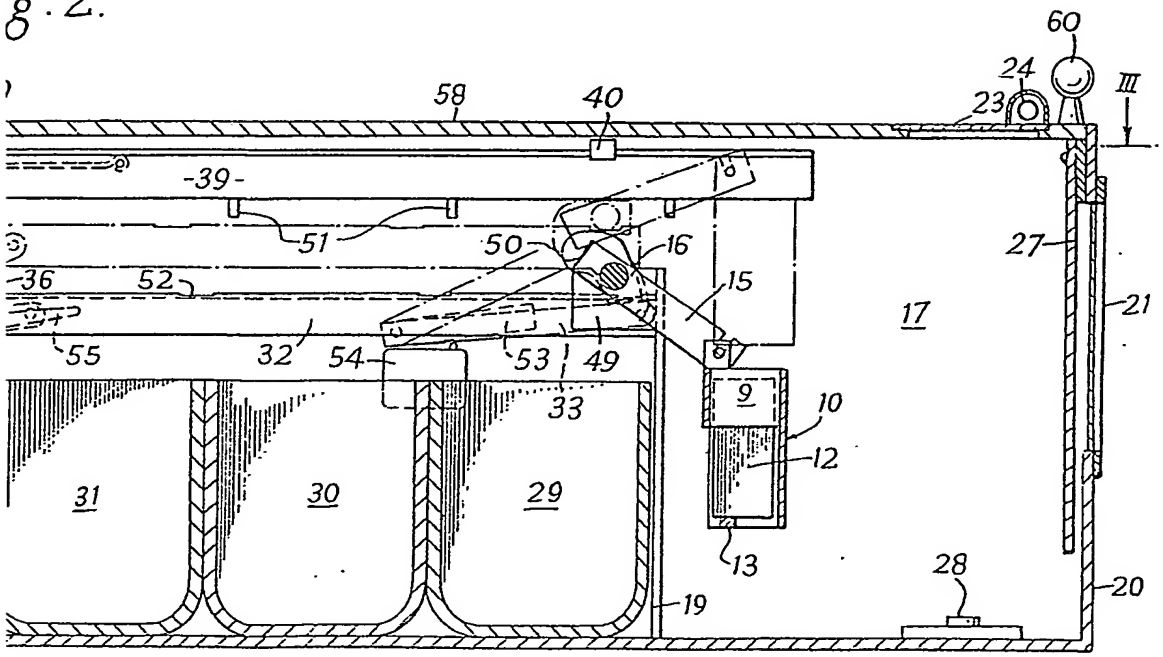

III
61
59
40
41
45'
-39-
35
44
36
52
46
55
43
34
56
37
48
42
48
47
31

1045496 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig. 1.



g. 2.



1045496 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

Fig. 1.

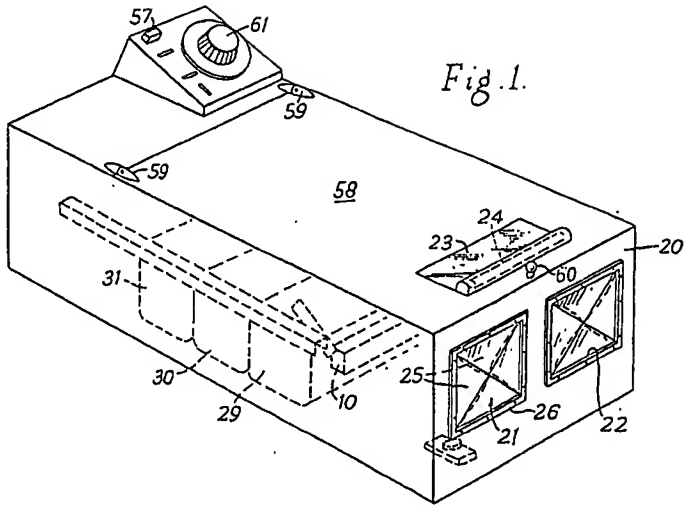


Fig. 2.

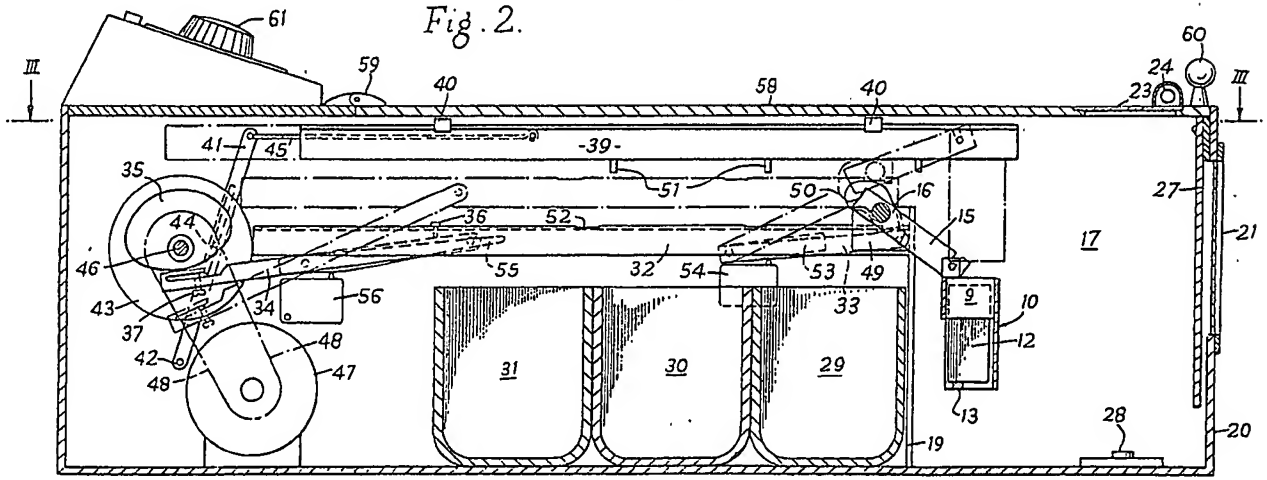
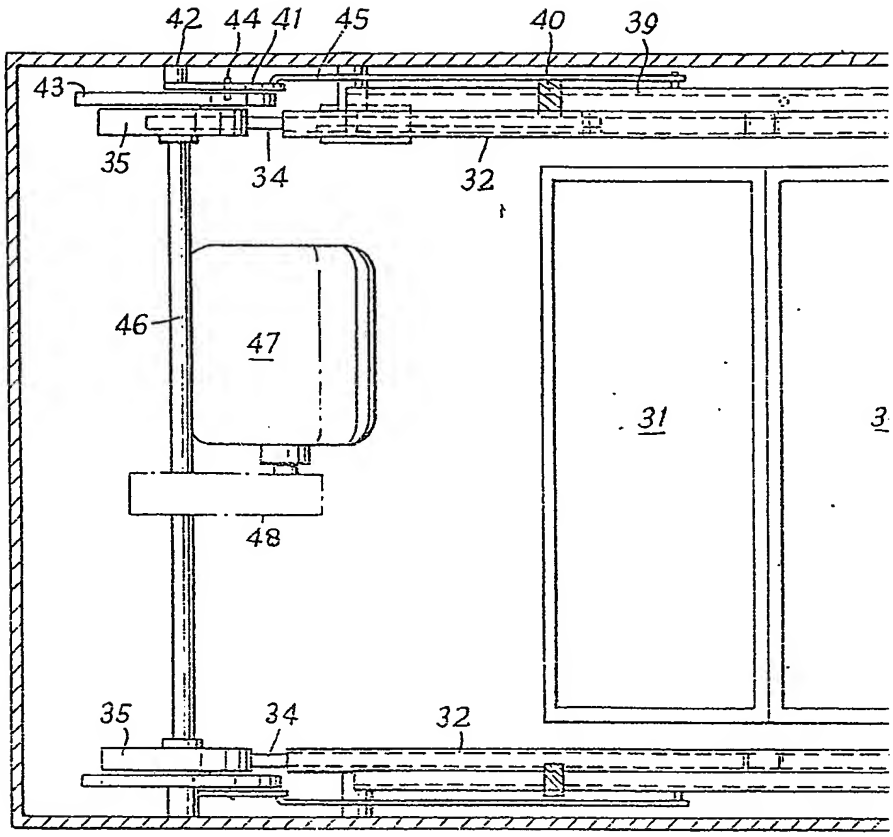
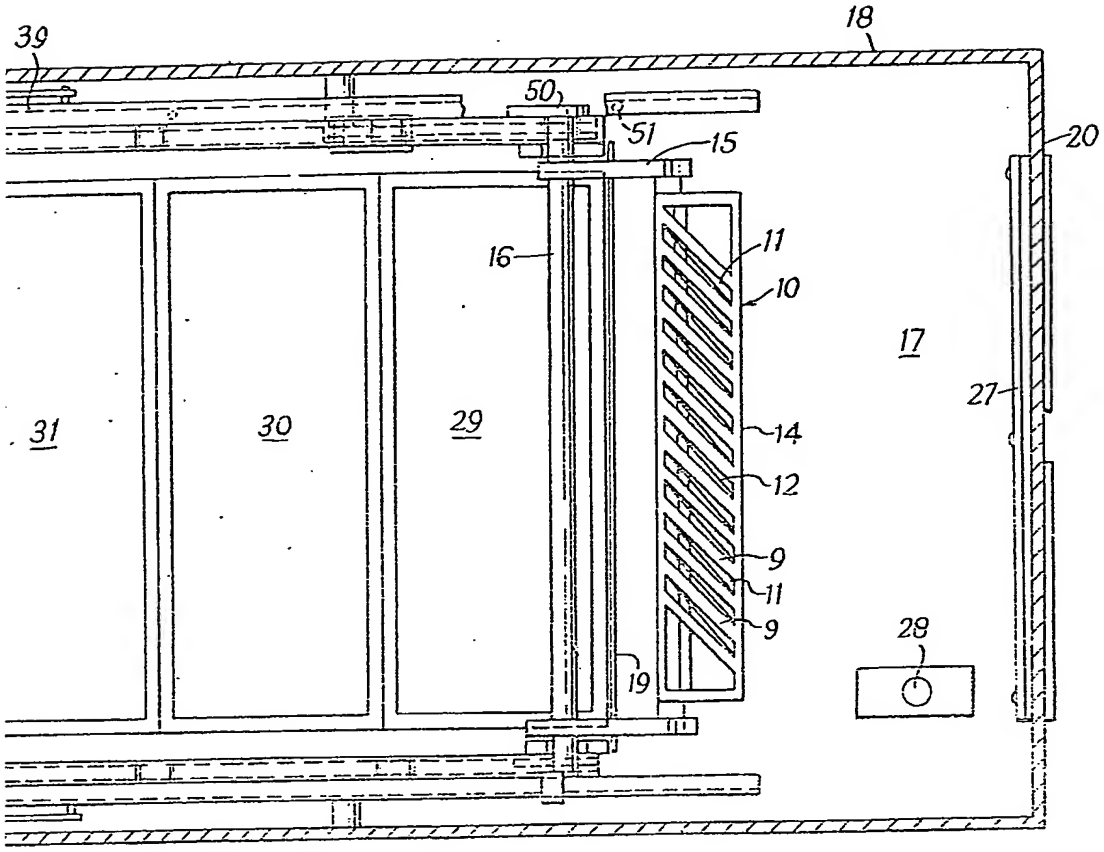


Fig. 3.



1045496 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

Fig. 3.



1045496 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

Fig. 3.